Remarks/Arguments

Claims 1-3, 5-14 and 16–26 are pending and claims 1-3, 5-14 and 16–26 stand rejected. In this response no claims are amended.

35 U.S.C. §103

In the Office Action, the Examiner rejected claims 1-3, 5-14 and 16–26 under 35 U.S.C. § 103(a) as being unpatentable over Modafferi, U.S. Patent No. 4,771,466 in view of Tanida, et al., US 5,243,656. In the final rejection, Examiner cited that Modafferi discloses, in column 2 lines 60 – 62,

> "impedances of the first and second components are selected such that a phase difference at the crossover frequency between respective responses of the first and second loudspeakers is no greater than 60 degrees".

Applicant respectfully suggests that the cited disclosure does not anticipate our claim element. Quoting from Modafferi column 2 lines 54 – 62,

> "If an ideal woofer were connected to a cross-over network having the transfer response of Equation (3) [$f_1(s) = 1/(1 + sT)$] and an ideal tweeter were connected to a crossover network having the transfer response of Equation (4) [$f_2(s) = sT/(1 + sT)$] , <u>and the woofer and tweeter were combined in a single system</u> (emphasis added), the result would be a "perfect" loudspeaker system. Its amplitude response would be perfectly flat for all frequencies and there would be no phase shift at any frequency."

Note first that Modafferi discusses the phase response vs frequency of a single signal, the combined high pass and low pass signals (note the equation at column 2 line 52: $f_3(s) = f_1(s) + f_2(s)$), whereas the independent claims of our application recite

> "a phase difference at the crossover frequency between respective responses of the first and second loudspeakers is no greater than 60 degrees"

Contrasted to Modafferi, we claim the phase difference between two different signals (high frequency filtered signal and low frequency filtered signal) at a fixed frequency, that frequency being the crossover frequency or the frequency where the amplitude response of the high pass signal and the low pass signal are equal, whereas Modafferi discloses characteristics of a single signal.

Note also that in the derivation of equations 3 and 4, Modafferi stipulates the same crossover frequency, 1/T, for the low pass filter and the high pass filter. In the system of notation used in Modafferi, the crossover frequency of 1/T is applied to both the low pass filter function, and the high pass filter function. In this notation, it is well known that 1/T connotes the -3 dB frequency of each filter. At the -3 dB frequency of the low pass filter, the phase response is -45 degrees with respect to the response at low frequency, while at that same frequency the phase response of the high pass filter is +45 degrees with respect to the response at low frequency. Thus when the outputs of the two filters are combined, either electrically of acoustically, the net response of the summation is a signal having no phase shift at any frequency. Note that, with first order filters, the amplitude response at the filters' corner frequency is –3dB and that in our application (as shown in exemplary figures 2A and 3A) the frequency at which the two filters have the same amplitude is at -6 dB. Thus, since we specify the filters to be first order filters, the crossover frequency of the high pass and low pass filters cannot be the same, nor at the corner frequency of the filters.

Figures 2 and 3 of our application show graphically a low pass and high pass filter example as described in our application on page 7 line 14 - page 8 line 6. In the example, the low pass filter and high pass filter do not crossover at their respective -3 dB points, but that they crossover at a frequency of 1 KHz, which is above the -3 dB point of the low pass filter and below the -3 dB frequency of the high pass filter. The significance of having the filters crossing over at a frequency which yields a phase difference between the respective filters' responses closer to zero degrees is described on page 6 lines 4 - 8.

Note also that in our application (as shown in exemplary figures 5A and 6A) the frequency at which the two filters have the same amplitude is at approximately -10 dB, this being described in the text (page 8 lines 7-17) as a system having about 40 degrees difference between the woofer and tweeter responses, with the filters' corner (or -3 dB) frequencies being even more remote from each other.

Note that Modafferi in column 2 lines 54 - 62 relates ideal responses which he describes subsequently (column 2 line 63 - column 3 line 8) as differing from realistic networks. It is to address improvement to realistic networks without adding cost to speaker systems that our application is directed. While Modafferi discloses that combining first-order high- and low- pass filters <u>using ideal speakers</u>, each filter having the same -3 dB frequency (in col. 2 lines 36-39, Modafferi points out the same corner frequency 1/T for each filter), provides a perfectly flat amplitude response and no phase shift at any frequency (see col. 2 lines 54-62). Rumreich, however, observes (pg. 2 lines 3-8)

> "Although the above first-order crossover network functions satisfactorily, the low-pass and high-pass filters at the crossover frequency are not in-phase. As such, such a first-order network cannot provide the following benefits of an in-phase crossover network: smoother

> frequency response due to increased stop-band rejection, and improved polar behavior (lobing)."

Rumreich teaches to improve the response of conventional first-order crossover networks with increased stop-band rejection, and improved polar behavior, by the claim 1 recitation

> "...a first component of the input audio signal coupled to the first loudspeaker to form a low-pass filter for providing the first loudspeaker low frequency band signals; and a second component of the input audio signal coupled to the second loudspeaker to form a high-pass filter for providing the second loudspeaker high frequency band signals, wherein the low-pass and the high-pass filters are first-order filters and wherein the first component is coupled in series to the first loudspeaker connected in a first polarity, the second component is coupled in series to the second loudspeaker connected in a second polarity, and the second polarity is an inverse of the first polarity, and impedances of the first and second components are selected such that a phase difference at the crossover frequency between respective responses of the first and second loudspeakers is no greater than 60 degrees."

Tanida discloses no first-order crossover network for dividing an input audio signal, no first component to form a low-pass filter, no second component to form a high-pass filter and no component of the input audio signal to a first speaker in a first polarity and no component of the input audio signal to a second speaker in a second polarity, and the second polarity being the inverse of the first polarity. Rather, Tanida discloses to improve the power efficiency in a multichannel audio circuit wherein a plurality of input signals are supplied to corresponding amplifiers having at least one of the input signals inverted and the speaker connected to the inverted signal connected in a polarity opposite the other speakers. Because of this double inversion, the net result is that the plurality of signals radiated from the corresponding speakers are all in the same phase or polarity. Note that there is no dividing of an input signal, one component being applied to a speaker in a polarity which is inverse to connection of a second component of the input audio signal. Tanida merely inverts one signal of a multichannel audio circuit twice, once in an amplifier and a second time by inverse connection of its corresponding speaker.

There is no suggestion in Modafferi or in Tanida, either singly or together, of

> "A first-order crossover network for dividing an input audio signal into high and low frequency bands at a crossover frequency in a loudspeaker system having first and second loudspeakers having respective impedance, each loudspeaker having positive and negative terminals, the first-order crossover network comprising:
> a first component of the input audio signal coupled to the first loudspeaker to form a low-pass filter for providing the first loudspeaker low frequency band signals; and a second component of the input audio signal coupled to the second loudspeaker to form a high-pass filter for providing the second loudspeaker high frequency band signals, wherein the low-pass and the high-pass filters are first-order filters and wherein the first component is coupled in series to the first loudspeaker connected in a first polarity, the second component is coupled in series to the second loudspeaker connected in a second polarity, and the second polarity is an inverse of the first polarity, and impedances of the first and second components are selected such that a phase difference at the crossover frequency between respective responses of the first and second loudspeakers is no greater than 60 degrees"

as is recited in claim 1. Applicant respectfully asserts the rejection is traversed.

Applicant respectfully requests the rejection of claims 1, 12 and 22 under 35 U.S.C. § 103(a) be withdrawn. Claims 2–3, 5-11, 13-21 and 23–26, being properly drawn to independent claims believed to be allowable are also allowable. Withdrawal of rejections of dependent claims 2–3, 5-11, 13-21 and 23–26 is respectfully requested.

Conclusion

Having fully addressed the Examiner's objections and rejections it is believed that, in view of the preceding remarks, this application stands in condition for allowance. Accordingly then, reconsideration and allowance are respectfully solicited. If, however, the Examiner is of the opinion that such action cannot be taken, the Examiner is invited to contact the applicant's attorney at (609) 734-6839, so that a mutually convenient date and time for a telephonic interview may be scheduled.

No additional fee is believed due. However, if an additional fee is due, please charge the additional fee to Deposit Account 07-0832.

Respectfully submitted,
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